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# Acute Exacerbation of Pulmonary Fibrosis And Complications of Noninvasive Positive Pressure Ventilation: A Case Report

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***Abstract***
*Idiopathic pulmonary fibrosis (IPF) is a chronic, progressive, fibrotic interstitial lung disease of unknown cause, often associated with characteristic radiologic and/or histopathologic pattern and occurs primarily in older adults. Acute exacerbation of IPF (AE-IPF) usually has poor outcomes, and mechanical ventilation has not been shown to benefit AE-IPF patients. Noninvasive ventilation (NIV) has attracted attention to avoid intubation in acute respiratory failure in AE-IPF.*

***Case report***
*We present a case of a 49-year-old male with AE-IPF placed on NIV that developed bilateral pneumothorax and pneumomediastinum as complications from NIV, who had to be intubated after being taken off NIV and eventually passed away.*

***Conclusion***
*Our case report highlights that NIV is also associated with complications and mortality in AE-IPF. AE-IPF patients and family should be informed of the very poor prognosis and the available options for treatment of respiratory failure in IPF, including the possible benefits and complications, and a joint decision should be made ahead of time on what to do in respiratory failure based on the goal of care.*

**Keywords:** *Acute exacerbation of idiopathic pulmonary fibrosis, Noninvasive ventilation, pneumothorax, pneumomediastinum, case report*

**Key message**: Acute exacerbation of IPF (AE-IPF) usually has a poor outcome, and mechanical ventilation has not been shown to benefit AE-IPF patients. Noninvasive ventilation (NIV) has attracted attention to avoid intubation in acute respiratory failure in AE-IPF. Our case report highlights that NIV is also associated with complications and mortality in AE-IPF.

Idiopathic pulmonary fibrosis (IPF) is a chronic, progressive, fibrotic interstitial lung disease of unknown cause, often associated with characteristic radiologic and/or histopathologic pattern and occurs primarily in older adults. [1,2] The diagnosis of IPF requires the presence of fibrosis with usual interstitial pneumonia (UIP) pattern on high-resolution computed tomography (HRCT) and the exclusion of other possible causes of interstitial lung disease such as autoimmune disorders and environmental exposures. [1,2] The UIP pattern on HRCT consists of heterogenous paraseptal fibrosis with distortion of the architecture. Honeycombing and ground-glass opacities are also common, and the distribution of UIP on HRCT is usually basal, peripheral, and patchy. Spirometry shows a restrictive lung pattern, while chest x-ray may be normal or show non-specific changes in the early stages of the disease or bilateral reticular infiltrates or opacities in advanced cases. [1,2] IPF is a fatal global lung disease with variable and unpredictable natural history. Patients with IPF usually present with chronic dry cough and unexplained dyspnea, which is often misdiagnosed as heart failure or chronic obstructive pulmonary disease. Most IPF patients develop gradually worsening lung function over the years while a minority remain stable or rapidly decline. [1,2]

Acute exacerbation of IPF (AE-IPF) usually has poor outcomes, and mechanical ventilation has not been shown to benefit AE-IPF patients. Noninvasive ventilation (NIV) has attracted attention to avoid intubation in acute respiratory failure in AE-IPF. [3] This is a case of an AE-IPF patient placed on NIV that developed NIV complications and eventually passed away. Our case report highlights that NIV is also associated with complications and mortality in AE-IPF.

## Case report

A 49-year-old male with underlying chronic obstructive pulmonary disease (COPD), pulmonary fibrosis, and past medical history of pancreatitis presents to the emergency department complaining of progressively worsening shortness of breath for 2 weeks. The patient was diagnosed with interstitial pulmonary fibrosis by his pulmonologist two months before admission based on a high-resolution computed tomography (CT) chest and just got his home

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oxygen before the presentation but has not started using it. The patient states that he is unable to walk eight feet without getting completely out of breath. He reports pleuritic chest pain, headaches, cough, which subsided and returned 48hours before admission, and sore throat. The patient is a former construction worker and uses marijuana but denies alcohol or tobacco use.

On admission, blood pressure was 142/85; heart rate was 110; the respiratory rate was 18; the temperature was 98.9F, and oxygen saturation on room air was 86%. Physical examination was benign, except for decreased breath sounds bilateral. Electrolytes were normal, and the white blood cell count was 2,900, hemoglobin 13.9, and platelets 214,000. CT angiogram showed no pulmonary thromboembolism but showed worsening ground glass opacities compared to his chest CT two months prior**.** The patient was admitted to the floor and started on IV antibiotics, bronchodilators, steroids, and oxygen supplementation through a nasal cannula. On day 15 of admission, the patient became more hypoxic and was transferred to the intensive care unit (ICU) and placed on bilevel positive airway pressure (BiPAP) to improve hypoxia. The next day (day 16), the patient developed prominent subcutaneous emphysema throughout the neck, chest, and back and severe pneumomediastinum with mild posterior displacement of the heart, raising suspicion for tension pneumomediastinum per the chest CT scan. **(Figure 1 and 2)** BiPAP was discontinued, and the patient was placed on high flow oxygen at 100% fraction of inspired oxygen (Fio2). The pneumomediastinum and subcutaneous emphysema improved by day 17 with the high flow oxygen, but the patient was still short of breath.

On day 18 of admission, the patient had a worsening respiratory failure with agonal breathing and was intubated. The patient developed bilateral tension pneumothorax post-intubation, and chest tubes were inserted. Persistent air leaks were noticed on both right and left chest tubes with suspicion of bronchopulmonary fistula. On day 24 of admission, the patient developed a cardiopulmonary arrest and passed away.

**Discussion**

Acute exacerbation of idiopathic pulmonary fibrosis (AE-IPF) has been defined as an unexplained acute, clinically significant respiratory deterioration with new, widespread alveolar abnormality and an absence of an alternative explanation such as pulmonary embolism or heart failure. [1,4] AE-IPF has a very poor prognosis with a reported median survival of about 3 to 4 months. [5,6]

The etiology of AE-IPF remains unclear but could be an intrinsic worsening of the underlying fibrotic lung disease or an acute lung injury and diffuse histopathological alveolar damage in response to occult external events (e.g., infection). [4,7]. Risk factors for AE-IPF include advanced disease, low forced vital capacity (FVC), the recent decline in FVC, increased dyspnea, low diffusing capacity for carbon monoxide (DLCO), low 6-minute-walk distance, pulmonary hypertension, poor baseline oxygenation, younger age, comorbid coronary artery disease, and higher body mass index.[5,6,8-15]

Unfortunately, no proven effective treatment for AE-IPF, and treatment is currently based on supportive care and unproven intervention. [1,4] Like our patient, many patients with AE-IPF received systemic steroids, but there is no strong evidence of its usefulness. [1,4] However, studies have suggested that treatment of IPF with nintedanib or pirfenidone (both currently approved for the treatment of IPF) may help prevent the development of acute exacerbation of IPF. [1]

The management of acute hypoxic respiratory failure in AE-IPF is challenging. The use of mechanical ventilation in AE-IPF has been associated with high in-hospital mortality. The international evidence-based guideline on the diagnosis and management of IPF makes a weak recommendation against its use in AE-IPF respiratory failure in the majority of patients. [1] Some authors have suggested the use of NIV like BiPAP in AE-IPF. Though NIV appeared to have initially helped our patient, unfortunately, it was complicated by severe pneumomediastinum and subcutaneous emphysema.

Appropriate patients with AE-IPF may benefit from a lung transplant. With estimated five-year survival rates after lung transplant of 50 to 56% in IPF, lung transplant in IPF have favorable long-term survival compared with other disease indications. [16,17]. AE-IPF patients can be placed on extracorporeal membrane oxygenation (ECMO), a lifesaving option for AE-IPF patients who are candidates for lung transplantation, as a bridge to lung transplantation. [18,19] However, ECMO is not helpful in patients who do not qualify for a lung transplant as it does not reverse the poor prognosis in AE-IPF. [18] Patients who might be candidates for lung transplant who present with AE-IPF in a facility without ECMO should be transferred to facilities that have ECMO as early as possible.

In conclusion, respiratory failure in AE-IPF has a very poor prognosis, and mechanical ventilation has been associated with high in-hospital mortality. The use of non-invasive ventilation has attracted attention to avoid intubation in acute respiratory failure in AE-IPF. However, our case report highlights that NIV is also associated with complications and mortality in AE-IPF. ECMO could be a lifesaving option for AE-IPF patients who are candidates for lung transplantation as a bridge to lung transplantation. In general, patient and family should be informed of the very poor prognosis and the available options for treatment of respiratory failure in IPF, including the possible benefits and complications, and a joint

decision should be made ahead of time on what to do in respiratory failure based on the goal of care.

## References


[1] Raghu G, Collard HR, Egan JJ, Martinez FJ, Behr J, Brown KK, Colby TV, Cordier JF, Flaherty KR, Lasky JA, et al.; ATS/ERS/JRS/ALAT Committee on Idiopathic Pulmonary Fibrosis. An official ATS/ERS/JRS/ALAT statement. Idiopathic pulmonary fibrosis: evidence-based guidelines for diagnosis and management. Am J Respir Crit Care Med, 183 (2011), 788–824.

[2] Lederer DJ, Martinez FJ. Idiopathic pulmonary fibrosis. New England Journal of Medicine. 10;378(19)(2018), 1811-23.

[3] Yokoyama T, Kondoh Y, Taniguchi H, Kataoka K, Kato K, Nishiyama O, Kimura T, Hasegawa R, Kubo K. Noninvasive ventilation in acute exacerbation of idiopathic pulmonary fibrosis. Internal Medicine., 49(15)(2010), 1509-14,.

[4] Collard HR, Ryerson CJ, Corte TJ, Jenkins G, Kondoh Y, Lederer DJ, Lee JS, Maher TM, Wells AU, Antoniou KM, Behr J. Acute exacerbation of idiopathic pulmonary fibrosis. An international working group report. American journal of respiratory and critical care medicine.,194(3) (2016 ), 265-75.

[5] Song JW, Hong SB, Lim CM, Koh Y, Kim DS. Acute exacerbation of idiopathic pulmonary fibrosis: incidence, risk factors, and outcome. Eur RespirJ; 37(2011), 356–363.

[6] Collard HR, Yow E, Richeldi L, Anstrom KJ, Glazer C; IPFnet investigators. Suspected acute exacerbation of idiopathic pulmonary fibrosis as an outcome measure in clinical trials. Respir Res.,(2013), 14:73.

[7] Collard HR, Moore BB, Flaherty KR, Brown KK, Kaner RJ, King TE Jr, Lasky JA, Loyd JE, Noth I, Olman MA, et al., Idiopathic Pulmonary Fibrosis Clinical Research Network Investigators. Acute exacerbations of idiopathic pulmonary fibrosis. Am J Respir Crit Care Med; 176 (2007), 636–643.

[8] Johannson KA, Vittinghoff E, Lee K, Balmes JR, Ji W, Kaplan GG, Kim DS, Collard HR. Acute exacerbation of idiopathic pulmonary fibrosis associated with air pollution exposure. Eur Respir J; 43 (2014), 1124–1131.

[9] Mura M, Porretta MA, Bargagli E, Sergiacomi G, Zompatori M, Sverzellati N, Taglieri A, Mezzasalma F, Rottoli P, Saltini C, et al. Predicting survival in newly diagnosed idiopathic pulmonary fibrosis: a 3-year prospective study. Eur Respir J., 40 (2012), 101–109.

[10] Ohshima S, Ishikawa N, Horimasu Y, Hattori N, Hirohashi N, Tanigawa K, Kohno N, Bonella F, Guzman J, Costabel U. Baseline KL-6 predicts increased risk for acute exacerbation of idiopathic pulmonary fibrosis. Respir Med., 108 (2014), 1031–1039.

[11] Schupp JC, Binder H, Jäger B, Cillis G, Zissel G, Müller-Quernheim J, Prasse A. Macrophage activation in acute exacerbation of idiopathic pulmonary fibrosis. Plos One., (2015),10:e0116775.

[12] Kondoh Y, Taniguchi H, Katsuta T, Kataoka K, Kimura T, Nishiyama O, Sakamoto K, Johkoh T, Nishimura M, Ono K, et al. Risk factors of acute exacerbation of idiopathic pulmonary fibrosis. Sarcoidosis Vasc Diffuse Lung Dis., 27 (2010), 103–110.

[13] Kishaba T, Tamaki H, Shimaoka Y, Fukuyama H, Yamashiro S. Staging acute exacerbation in patients with idiopathic pulmonary fibrosis. Lung., 192 (2014), 141–149.

[14] Kondoh Y, Taniguchi H, Ebina M, Azuma A, Ogura T, Taguchi Y, Suga M, Takahashi H, Nakata K, Sugiyama Y, et al. Risk factors for acute exacerbation of idiopathic pulmonary fibrosis: an extended analysis of pirfenidone trial in Japan. Respir Investig., 53 (2015), 271–278.

[15] Reichmann WM, Yu YF, Macaulay D, Wu EQ, Nathan SD. Change in forced vital capacity and associated subsequent outcomes in patients with newly diagnosed idiopathic pulmonary fibrosis. BMC Pulm Med., (2015), 15:167.

[16] Mason DP, Brizzio ME, Alster JM, McNeill AM, Murthy SC, Budev MM, Mehta AC, Minai OA, Pettersson GB, Blackstone EH. Lung transplantation for idiopathic pulmonary fibrosis. Ann Thorac Surg, 84(2007), 1121–1128.

[17] Keating D, Levvey B, Kotsimbos T, Whitford H, Westall G, Williams T, Snell G. Lung transplantation in pulmonary fibrosis: challenging early outcomes counterbalanced by surprisingly good outcomes beyond 15 years. Transplant Proc., 41 (2009), 289–291.

[18] Trudzinski FC, Kaestner F, Schäfers HJ, Fähndrich S, Seiler F, Böhmer P, Linn O, Kaiser R, Haake H, Langer F, Bals R. Outcome of patients with interstitial lung disease treated with extracorporeal membrane oxygenation for acute respiratory failure. American journal of respiratory and critical care medicine.,193(5)(2016), 527-33.

[19] Lafarge M, Mordant P, Thabut G, Brouchet L, Falcoz PE, Haloun A, Le Pimpec-Barthes F, Maury JM, Reynaud-Gaubert M, Saint-Raymond C, Sage E. Experience of extracorporeal membrane oxygenation as a bridge to lung transplantation in France. The Journal of Heart and Lung Transplantation.32(9) (2013), 905-13.

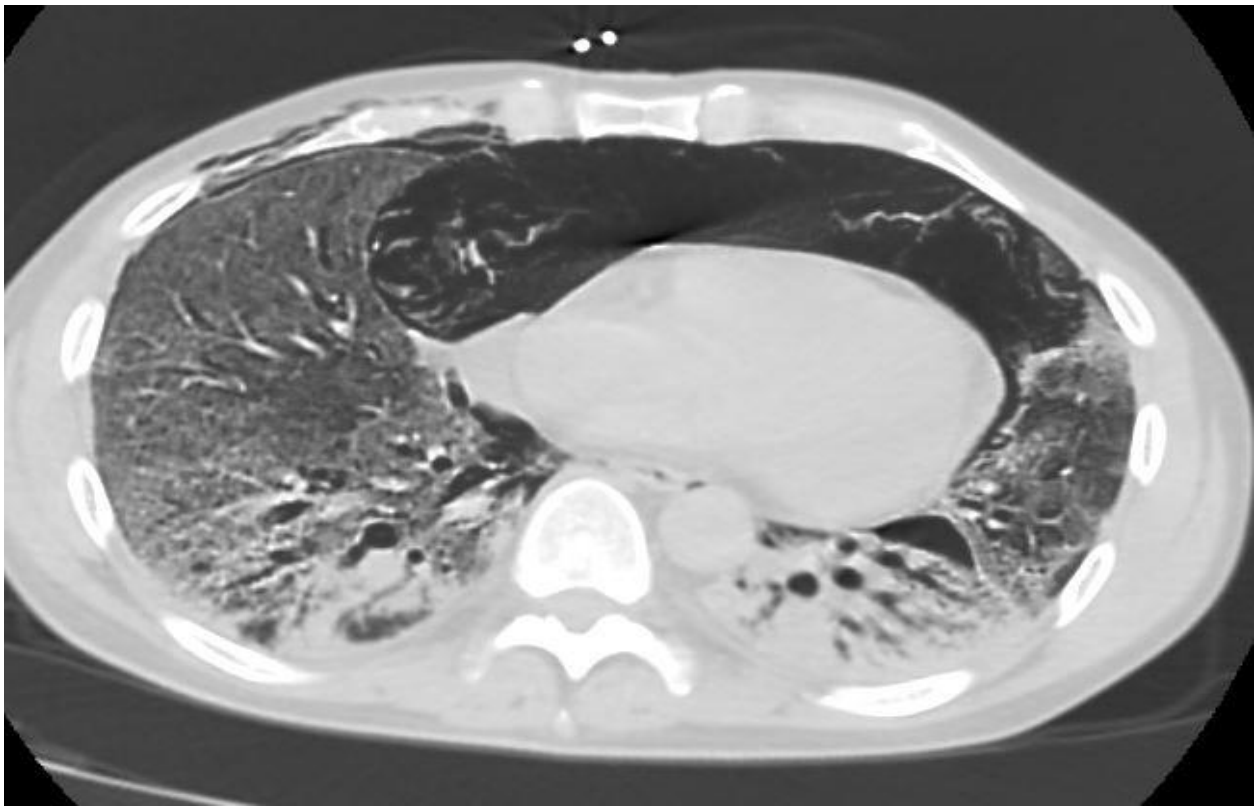

**Figure 1: Pneumomediastinum with slight posterior displacement of the heart (sagittal plane)**

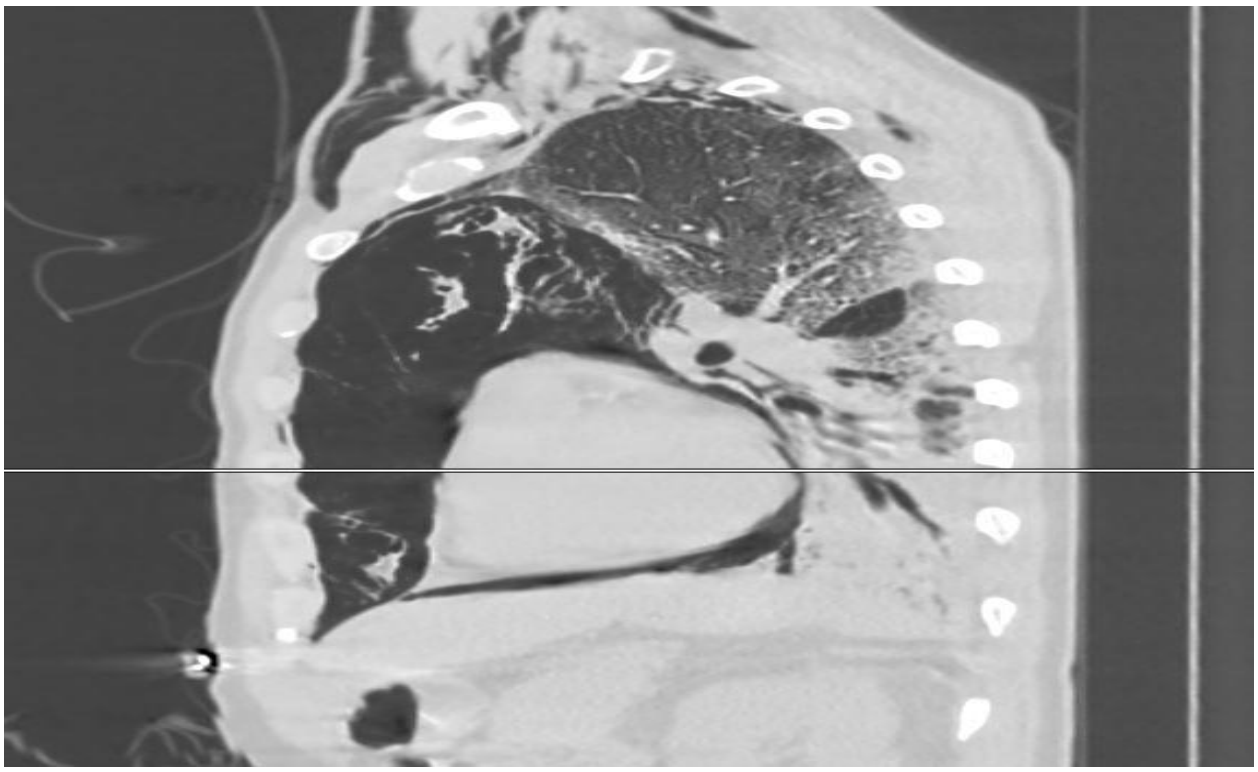

**Figure 2: Pneumomediastinum with slight posterior displacement of the heart (transverse plane)**